The knowledge package
[v1.09 — 2017/10/31]

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Abstract

The knowledge package offers automatic tools and commands for helping the writer of a (scientific) document to have all notions (hyper)linked to places where these are defined. Using the standard tools of \textsc{TeX} for doing that would be extremely tedious. Eventually, it is intended to use the package for producing scientific semantic aware documents.

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This is still in beta version but close to a first definitive release. A lot of functionalities are perfectly operational, and the syntax is close to stable. At any rate, if changes happen, these will only affect a few lines in the configuration of the document.
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1 History

2016-06-07 \knowledgemacro is now renamed to \knowledgedirective.

2017-01-13 \AP has been recoded, and is now more properly aligned in the margin. The visible anchor points option has also been made usable without the \xcolor package.

2017-01-13 The package \scopeoption can now be omitted. This in particular avoid clashes with the over-restriction on the structure of the document it entails. It should be improved to stop overloading the \begin command.

2017-01-14 The overloading of \begin and \end was done as protected commands, which should not be the case to be consistent with the behaviour of \LaTeX (for instance, this was giving an extra line in the title in the conference mode of the class IEEEtran). Corrected: these commands are not protected anymore.

2017-01-15 A workaround for an incompatibility between the \hyperref and the two-column mode as been added in the macro \knowledgeFixHyperrefTwocolumn (thanks to Daniela Petrisan).

2017-01-15 Added the directive synonym.

2017-01-15 Added the noknowledge package for minimizing the effects of not having knowledge activated.

2017-01-17 Changed the way options are handled, decoupling the package options (options of \usepackage) from the configuration options (see \knowledgeconfigure).

2017-01-17 Proper treatment of ‘final’ option and composition options.

2017-01-17 Added \IfKnowledgeFinalMode \[TF\] commands for the user.

2017-01-17 Added the option fix hyperref twocolumn as a shorthand for calling \knowledgeFixHyperrefTwocolumn (thanks to Daniela Petrisan and Luca Reggio).

2017-01-18 Added the configuration option notion that offers a basic configuration compatible with \xcolor or not, and final and composition modes.

2017-01-19 Added \phantomintro and an explanation on how to deal with align*.

2017-02-20 Removed the warnings of latex for unknown labels in \autoref.

2017-02-20 Removed nasty error making \AP not operative when anchor points were not visible.

2017-02-21 Added the protect link directive.

2017-02-21 Added the \hyperlinks configuration.

2017-02-27 Visible anchor points is active by default now.

2017-02-27 A simple example is now included.

2017-02-28 Added the \scope environment.

2017-02-28 Added the protect link and unprotect link \configuration directives.

2017-02-28 Added the \knowledgeconfigure environment command.

2017-03-03 Added the \breaklinks faq (thanks to Luca Reggio for the request).

2017-03-10 Added the \"\cdot\cdot\cdot\" and \"\cdot\cdot\cdot\" notations and the \quotation mode (requested by Gabriele Puppis and Andreas Krebs).

2017-03-11 Added the \"\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\cdot\·
2017-04-09 Added the protect quotation configure option, that is given a list of environments, and deactivates automatically the quotation notation when in there environments. This is a simple code for the moment. Typically, one can use \knowledgeconfigure{protect quotation=tikzcd}. For the moment, it is not explained in the document.

2017-04-19 Changed the display code such that nested knowledges behave properly: before, the introduction would be performed for the object and the subobjects.

2017-04-20 The electronic mode has been added, and the ‘final mode’ is now renamed into paper mode. The \knowledgepackagemode configuration variable is also available for easier scripting.

2017-06-06 FAQ on deactivating the quote in Emacs (thanks to Sylvain Perifel).
2017-06-08 Removed the noknowledge package and all references to it.
2017-06-08 Removed the knowledgeutils.sty and scopearticle.sty which are now integrated in the main file.
2017-06-08 The file knowledge-example.sty as been improved.
2017-06-09 First release of version 1.0 on CTAN
2017-06-10 Corrected the quotation notation to make it expandable for avoiding problems in table of contents (the @ was not working).
2017-06-11 Corrected a bug linked to changes of expl3 on recent distributions (pointed by Murray Eisenberg)
2017-06-11 Release of v1.01
2017-06-27 Overloaded labels now perform an expansion of the argument (this was causing problems with biblatex).
2017-06-28 Options log-declarations of xparse package removed (causing clash with other packages, as pointed by Juliusz Chroboczek).
2017-06-30 added the field labelizable_bool to areas. Coded missing features of scoping. Now the scope=directive works with as parameter an enclosing area, or a label.
2017-06-30 Added in the source a Regression subdirectory containing files to be tested (so far only one: regression-scope.tex)
2017-07-01 Corrected a conflict between the scope and makeidx option.
2017-07-03 Scoping becomes operational.
2017-07-04 The documentation for notion and intro notion are added (thanks to Fabian Reiter).
2017-07-09 The boolean environment_bool has been added to areas in order to not always trigger the scope from an environment. Now the environment document has this Boolean set to false, and it resolves a bug with the package standalone noticed by Fabian Reiter.
2017-07-20 Scoping becomes fully operational, with the parenthesis notation of kl and intro. The use of scope has been recoded. Now scope links reuse implicitly the key as a link. Documentation updated.
2017-07-26 File and line numbers added in the kaux file. Added the option diagnose line to deactivate it.
2017-07-26 Corrections to the documentation.
2017-07-26 Version 1.03.
2017-07-28 Corrected a bug of scoping in the context of synonyms. Added ctan for producing the ctan zip file.
2017-08-06 Now passes the compliance test check-declarations of expl3 (thanks to
Marc Zeitoun)

2017-09-12 The \texttt{hidelinks} option of \texttt{hyperref} is now always activated.

2017-09-25 Ancient version of \texttt{xparse} does not have \texttt{\textbackslash NewExpandableDocumentCommand}. Corrected.

2017-09-26 Version 1.05 on \texttt{CTAN}.

2017-10-10 Bug in the implementation of \texttt{\textbackslash knowledgenewvariant} (that was invisible for older versions of \texttt{expl3}). Found and corrected (thanks to Marc Zeitoun).

2017-10-10 Version 1.06 on \texttt{CTAN}.

2017-10-15 Diagnose extended (suggested by Fabian Reiter). Minor corrections. Version 1.07 on \texttt{CTAN}.

2017-10-17 Added \texttt{cyclic color} and \texttt{cyclic colors=} Reorganization of the structure of the code for producing a better \texttt{CTAN} archive. Version 1.08 on \texttt{CTAN}.
2 Quick start

The \texttt{knowledge} package offers several capabilities for handling colors, changing the display style, defining internal and external hyperlinks, producing an index, etc... All these possibilities arise from defining explicitly or implicitly \texttt{knowledges} associated to terms in plain english (or other languages).

We start by describing a certain number of problems/scenarios that a user may be confronted to, and show how to solve them. The hyperlinks in this document have been generated using the \texttt{knowledge} package. In the subsequent questions, a more detailed account of how the \texttt{package} works and can be parameterized is given.

There is also a file \texttt{knowledge-example.tex} that can be used as a starting point.

2.1 Linking to outer documents(urls), and to labels

The problem I have a lot of external url's that I would like to [very] often have a link to, but I do not want to always type the full url. I do not want to remember weird labels/internal references/macro names either.

A solution is as follows. One first loads the \texttt{knowledge} package with option \texttt{hyperref} using either:

\begin{verbatim}
\usepackage[hyperref,quotation]{knowledge}
\end{verbatim}

or:

\begin{verbatim}
\usepackage{hyperref}
\usepackage[quotation]{knowledge}
\end{verbatim}

\texttt{a}If you want to use the "···" notation.

Then, in the preamble (or in an external file), one uses commands of the form:

\begin{verbatim}
\knowledge{latex}{url={https://en.wikipedia.org/wiki/LaTeX}}
\end{verbatim}

This configures the text 'latex' to be associated with the sole directive \texttt{url=}, which means an hyperreference to this address.

Finally in the body of the paper, the sole extra command \texttt{kl} (or the "···" symbol if the \texttt{quotation} option is activated) is used, with as parameter a text. This text is searched for, and the directives attached to it (here the url), are used for formatting its printing\footnote{This resembles a lot a macro so far. It nevertheless differs in that: (a) if not defined, it does not make the compilation fail as a macro would, and thus does not interfere with the writing process, (b) any text can be used and not only alphabetic letters as in \TeX, (c) you do not have to care about the space after, and (d) in fact the machinery for resolving the meaning of a knowledge is much more powerful than simple macro execution.}. Hence:

This package has been written for use in \texttt{kl}[latex].

or, if the \texttt{quotation} option is activated,
This package has been written for use in "latex".

yields

```
This package has been written for use in \LaTeX.
```

**Variation.** But in fact, I would like ‘latex’ to also be properly typeset \LaTeX, and in gray. This requires to load the package with the \texttt{xcolor} option (for being able to use colors, obviously), or by loading the package \texttt{xcolor} before, and then modify the \texttt{knowledge} command using extra directives:

```
\knowledge\{latex\}[url=https://en.wikipedia.org/wiki/LaTeX, text=\LaTeX, color=gray]
```

yields with the same text

```
This package has been written for use in \LaTeX.
```

The \texttt{color=}, \texttt{text=} and have quite obvious meaning. \texttt{Directives} can also control the style using \texttt{emphasize } \texttt{\texttt{boldface } } \texttt{italic } \texttt{typewriter } and so on. See Section 5.3 for a complete list of \texttt{directives}.

**Variation (synonyms).** It happens very often that there are several ways to name a notion, because of capitalized letters, conjugacy, grammar, or simply because it is not explicitly named in the text. There are two ways to resolve this issue. The first is to use the syntax

```
\kl\{knowledge\}[text]
```

the result is that the text ‘text’ is displayed, but urls, colors, etc from ‘knowledge’ are used.

Another more systematic way to do it is to declare synonyms. This can be achieved using a ‘|’ separated list of texts in the \texttt{optional parameter} of the \texttt{knowledge} command, it is possible to add a list of ‘synonyms’, such as in:

```
\knowledge\{latex\}[LaTeX|Latex|LATEX]
```

This is interesting for people’s name that can be displayed in various ways depending on the context. Hence

```
\knowledge\{Donald Ervin Knuth\}[Donald Knuth|Knuth]
```

would allow

```
\kl\{Knuth\} as well as \kl\{Donald Knuth\},
```

or simply “Knuth” as well as "Donald Knuth" and so on.

---

**Hint.** This is a shorthand for a \texttt{synonym} (or \texttt{link}) directive.

For instance, with the code

```
\knowledge\{D. Knuth\}
```

then \texttt{\kl\{D. Knuth\}} would also point to the same url.

```
\knowledge\{D. Knuth\}
```

would also work if used just after the definition of Knuth.
to all point to the same web address. It is even more convenient to use it for nouns
that are sometimes in plural form or at the beginning of a sentence. Hence:

\texttt{\textbackslash knowledge\{group\}[groups|Groups|group morphism|group
morphisms|Group morphisms]\{url=https://en.wikipedia.org/wiki/Group\_(mathematics)\}}

makes it possible to use the notions in many contexts:

"Groups" form a category when equipped with "group morphisms".

### 2.2 Linking inside a document

The problem

I am writing a long scientific document with many notions tied
together (typically, I have made all my best for clarifying but nevertheless it
remains obscure, or it is a long survey involving many subfields, or a book, or a PhD
thesis\footnote{Reviewers should appreciate...}). I would like all the notions be linked inside the document for being able
in one click, whenever something is used, to jump to its definition. However, I do
not want it to be a hassle when writing.

A solution is as follows. First load the \texttt{knowledge} package in the preamble:

\usepackage[xcolor,hyperref,notion,quotation]{knowledge}

with suitable options: \texttt{hyperref} for links, \texttt{xcolor} for colors (if required, but always
advised), \texttt{quotation} for using the \texttt{quotation notation} and \texttt{notion} for automatic
configuration of the \texttt{notion} directive.

Then write the document using \texttt{\intro} (or ""···"" if \texttt{quotation} is activated)
when a notion is defined/introduced, and \texttt{\kl} (or ""···"" if \texttt{quotation} is activated)
when it is used. For instance:

\begin{verbatim}
\AP A \intro{semigroup} is an ordered pair $(S,\cdot)$ where
\texttt{\cdot} is an associative binary operator over $SS$.
\end{verbatim}

\begin{verbatim}
\AP A \intro{monoid} $(M,\cdot,1)$ is a \kl{semigroup} $(M,\cdot)$ together with a neutral element $1$.
\end{verbatim}

or when the \texttt{quotation notation} is activated:

\begin{verbatim}
\AP A ""semigroup"" is an ordered pair $(S,\cdot)$ where $\texttt{\cdot}$ is an associative binary operator over $SS$.
\end{verbatim}

\begin{verbatim}
\AP A ""monoid"" $(M,\cdot,1)$ is a "semigroup" $(M,\cdot)$ together with a neutral element $1$.
\end{verbatim}

This yields

Note that the \texttt{AP} command is made visible thanks to a red corner.
A semigroup is an ordered pair \((S, \cdot)\) where \(\cdot\) is an associative binary operator over \(S\).

A monoid \((M, \cdot, 1)\) is a semigroup \((M, \cdot)\) together with a neutral element 1.

Undefined knowledges are in brown (it is an important feature that the compilation does not fail: undefined knowledges should not interfere with the writing of the document, which is the purpose of all this). One can now see the list of such problems in the file `filename.diagnose`. One can in particular find in the "Undefined knowledges" section:

\knowledges{semigroup}{}
\knowledges{monoid}{}

Which means that both ‘monoid’ and ‘semigroup’ are unknown knowledges.

To solve this, let us copy these two (or more) lines in the paper adding the notion directive (which is a configured version of the autoref directive, meaning essentially that you want to use the features of the \intro command), i.e., in the preamble:

\knowledges{semigroup}{notion}
\knowledges{monoid}{notion}

The result is then (after two compilations):

A semigroup is an ordered pair \((S, \cdot)\) where \(\cdot\) is an associative binary operator over \(S\).

A monoid \((M, \cdot, 1)\) is a semigroup \((M, \cdot)\) together with a neutral element 1.

Clicking on ‘semigroup’ now jumps to the place it was introduced, and very precisely at the location of the red corner depicting the presence of the \AP command. If now one adds the option \electronic while loading the package, then the colors and the red corner disappear. When using the option \paper, the links are still there, but all texts are in black.

It is very often the case that for plain english (or other languages) some terms can be used in several forms; verbs can be conjugated; nouns can be plural, and so on. So usually the lines added to the file look more like:

\knowledges{semigroup}{semigroups|Semigroups}{notion}
\knowledges{monoid}{monoid|Monoids}{notion}

Now, using code like

"Monoids" and "semigroups" play the same role from now.

will properly be linked to the definition of a semigroup and a monoid.

\footnote{It is good practice to use a separate file, something like ‘paper-knowledge.tex’.}
2.3 Mathematics

The examples above show various techniques for using `\text{knowledge}` for enhancing the information associated to terms. In fact, these techniques are not incompatible with mathematics. Imagine, for instance that you would like each time a macro `\text{monoid}` is met, to display $\mathcal{M}$, you would do for instance:

```
\newrobustcmd{monoid}{\mathcal{M}}
```

Imagine that furthermore, you would like to hyperlink to the definition of a monoid. A standard `\text{kl}` command does the job:

```
\newrobustcmd{monoid}{\text{kl}[monoid]{\mathcal{M}}}
```

What is $\text{M}$ ?

The problem

But I want more. I want to be able to introduce variables. Even better, I would like to be able to have variables hyperlinking to the place of their introduction, knowing that the same variable name may mean different things depending on the lemma or proof we are in. Hence, I want to properly control the scope of knowledges.

To be done, this requires to use `\text{scoping}`. The principle of `\text{scoping}` is that a knowledge can be attached to a particular context. This is particularly true when typesetting mathematics: a variable is meaningful inside a statement, and inside the proof of the statement. Furthermore, the same variable name may reappear elsewhere with a different meaning.

The following code gives an idea of what is possible using `\text{scoping}`:

```
\knowledgeconfigureenvironment{theorem,lemma,proof}{}
[...]
\begin{lemma}\label{theorem:main}
\knowledge{n}{notion}
For all number $\text{intro} n$, [...]
\end{lemma}
[...]
\begin{proof}[Proof of theorem˜{theorem:main}]
\knowledgeimport{theorem:main}
Inside the proof, $\text{kl} n$ is hyperlinked to the theorem...
\end{proof}
```

More on `\text{scoping}` can be found in Section 3.5.

The use of `\text{variants of kl}` is also useful for typesetting mathematics. It allows for instance, to implicitly execute the `\text{knowledge}` command at the same time of the introduction. See 3.4.3 for more detail.

It is highly advised to not use the `\text{quotation notation}` in math mode or macros.
3 Usage of the \texttt{knowledge} package

3.1 Options and configuration

Options are used to activate some capabilities. Some options have to be used when loading the \texttt{knowledge} package, while some others can also be used inside the document thanks to the use of \texttt{knowledgeconfigure}. In this section, we review these \textit{package options}.

3.1.1 Options at package loading

The options that can be used in the optional parameter of \texttt{usepackage} when loading the \texttt{knowledge} package belong to the following classes:

\textbf{Writing mode} The \texttt{paper}, \texttt{electronic} or \texttt{composition} modes are possible (\texttt{composition} is by default) (see Section 3.1.2 for more details). These modes change several default rendering settings.

\textbf{Other packages} some of the options concern the loading and the use of other packages (\texttt{hyperref}, \texttt{xcolor}, ...). This is explained in Section 3.1.3.

\textbf{Configuration options} as used by the command \texttt{knowledgeconfigure} can be used when loading the package.

\textbf{Scoping} The \texttt{scope} option makes the package aware at a fine level of the structure of the document (see Section 3.5 for explanations). This provides, for instance, the possibility to define pieces of \texttt{knowledge} that are attached to a section of the documents.

3.1.2 Writing mode

Other \textit{package options} of \texttt{knowledge} concern the \textit{writing modes}. There are three of them:

- In \texttt{paper} mode, the paper is rendered as for printing: in particular, no informative colors are visible. Hyperlinks are nevertheless present.

- In \texttt{electronic} mode, the document has some colors witnessing the existence of the links for the reader to know that clicking is available.

- In \texttt{composition} mode, the document has colors helping the writing: \texttt{undefined knowledge}s appear explicitly, \texttt{anchor points} are displayed, and so on.

Activating the modes is obtained either at load time using one of:

\begin{verbatim}
\usepackage[\texttt{paper}]{knowledge}
\end{verbatim}

or

\begin{verbatim}
\usepackage[\texttt{electronic}]{knowledge}
\end{verbatim}

or

\begin{verbatim}
\usepackage[\texttt{composition}]{knowledge}
\end{verbatim}

or by setting before loading the variable \texttt{knowledgepackagemode} as in:

\begin{verbatim}
\def\knowledgepackagemode{\texttt{paper}}
\end{verbatim}

The idea is that this can be used in automatic compilation scripts. For instance,
launching in a terminal:

```
pdflatex "\def\knowledgepackagemode{electronic}\input{file.tex}" 
```

would result in compiling 'file.tex' using knowledge in electronic mode.

The following primitives are available in order to be mode-dependent:

```
\IfKnowledgePaperModeTF{true code}{false code}
\ifKnowledgePaperMode true code \else false code \fi
\IfKnowledgeElectronicModeTF{true code}{false code}
\ifKnowledgeElectronicMode true code \else false code \fi
\IfKnowledgeCompositionModeTF{true code}{false code}
\ifKnowledgeCompositionMode true code \else false code \fi
```

### 3.1.3 Automatic loading of other packages

A certain number of package options coincide with the loading of other packages. For the moment, the packages that are concerned are `hyperref`, `xcolor`, and `makeidx`.

For activating these functionalities, it is sufficient, either to load the package before the `knowledge` package, or to name it explicitly as an option for `knowledge`. Loading separately the package is convenient for setting options for it. For instance, a typical preamble may look like:

```
\documentclass{article}
\usepackage[svgnames]{xcolor}
\usepackage[draft]{hyperref}
\usepackage{makeidx}\knowledge
```

Such a sequence will activate the `knowledge` package using the features related to `xcolor` configured with `svgnames` option, to `hyperref` configured with `draft` option, and to `makeidx` with its standard configuration.

In fact, the syntax when a package is loaded as an option of `knowledge` is of the form 'package=choice' in which choice can take the following values:

- **active**: The package will be loaded, and all the capabilities that it triggers are activated. This is the implicit meaning when nothing more is specified.
- **inactive**: The package is not loaded, and no capabilities are activated (even if it had been loaded previously by another `\usepackage` command).
- **compatibility**: The package is not loaded. The directives it used do not cause any error, but have no effect.
- **auto**: If the package was loaded before, then the associated capabilities are activated. This is the default behavior when the package is not named while loading.

Currently, the packages that can be loaded are:
hyperref which activates all the (auto)referencing capabilities.

xcolor which activates coloring commands.

makeidx for handling the index automatically.

3.1.4 Configuring and \knowledgeconfigure

Some part of the configuration can be done outside of the \usepackage command that loads the \knowledge package. This is done using the \knowledgeconfigure command:

\knowledgeconfigure{configuration directives}

Note that by default, the configuration directives used by \knowledgeconfigure can be used in the optional parameter of \usepackage when loading the \knowledge package, but the converse is not true. Configuration directives consists of a comma separated list of elements that can take the following values:

diagnose line= can be set to true or false. It activates or deactivates the line numbering in the diagnose file. False is the default.

fix hyperref twocolumn triggers a hack that solves a known problem that may occur when hyperref is used in two-columns mode.

notion configures the notion directive which is a refined version of \autoref.

protect quotation= is followed by a comma separated list of environments in which the quotation notation will be automatically deactivated (surrounded by braces if more than one item in the list).

protect link and unprotect link starts and ends respectively a zone in which the \knowledge package do not create hyperlinks. These can be nested. This is typically useful around, e.g. the table of contents.

quotation activates the quotation notation, which allows to use "...", "...", "...", and "..." instead of \kl commands and "...", "...", and "..." instead of the \intro command.

visible anchor points is an option that makes visible or invisible the anchor points of the \AP and \itemAP commands.

3.2 What is a knowledge?

A knowledge is often informally used in this document. Essentially, it captures what is an elementary concept in the document. Internally, a knowledge is identified by three components:

The knowledge name is a \TeX string that has almost no limitation (but being well balanced, and containing no \). It is the text entered by the user for defining and using the knowledge
The **scope** which is a simple string identifying where the **knowledge** is usable. The scopes are generated by the system. For instance, internally, each section will be uniquely named ‘section-1’, ‘section-2’, and so on (this is invisible for the user). Each **knowledge** is primarily valid in exactly one such **scope**. Knowledges defined in the preamble are given the **scope** ‘document’. Usually, the user refers to scope using, for instance, labels.

The **namespace** is a simple string that is used for avoiding clashes. It is most of the time simply ‘default’. It is ‘style’ for **styles** that are internally as knowledges. It is a possibility available to a developer to, when developing a new set of functionalities, use a different **namespace** for avoiding clashes of names (for instance if one wants a french and an english set of knowledges that should not conflict, and would use separate sets of macros). Usually, a normal user does not see **namespaces**.

### 3.3 The **knowledge** command and variations

In this section, we describe the main commands that create **knowledges**. The main one is **knowledge**. It can also be used in combination with **knowledgedirective**, **knowledgestyle** and **knowledgedefault**.

#### 3.3.1 General description of the **knowledge** command

The key command for introducing knowledges is **knowledge**. The syntax is:

```
\knowledge{knowledge name}[synonyms]{directives}
```

The **knowledge name** is a string describing the knowledge. It may use any combination of symbols (well balanced with respect to brackets). This string will be used to fetch the **knowledge**. Note (and this is a standard TeX behavior) that several consecutive spaces is the same as one or a line feed. The **synonyms** are **knowledge names** given in a ‘|’ separated list. This is a shorthand for writing **link-directives** (Note that there is another way to define synonyms using the **synonym** directive). The **directives** consists of ‘key=value’ statements in a comma separated list. There are many **directives**. A list can be found in Section 5.3. New ones can be defined using the **knowledgedirective** command.

The principle of the **knowledge** command is to introduce a new **knowledge** ready for being used. However, what it does exactly depends a lot on the situations. First, the **directives** (a comma separated list of ‘key=value’ commands) are parsed, and from it, the namespace and scope of the knowledge are determined, and it is decided if it will be executed immediately or postponed to the next compilation phase. Only then, either the **knowledge** is written in the **kaux file** for execution during the next compilation phase, or it is executed immediately. Finally, **synonyms** are parsed and linked to the **knowledge**.
3.3.2 Targeting and the corresponding directives

The \knowledge has to decide what to do when defining something. The basic behaviour is as follows.

- If the \knowledge command is used in the preamble, then the \knowledge given as argument is defined immediately (the same effect can be obtained using the now directive), and is accessible in the first compilation phase everywhere in the document (one extra phase is nevertheless required if autoref or ref= directives are used, for the hyperref to do its job, or if scope= is used). This is the simplest way to use \knowledge.

- Import/Export (not implemented) writes a document containing a list of \knowledge commands giving access to its content. This is to be imported by another document.

- Otherwise, the \knowledge is written in an external file (the jobname.kaux file), and the \knowledge will be really usable in the next compilation phase. This is particularly useful in conjunction with the scope option; the \knowledge will have a scope depending on where it is introduced (for instance the document, or a theorem, or a lemma). The same \knowledge name can then point to different \knowledges depending on where it is used.

The targeting directives refine the above defined behaviour:

- **scope=** When using a directive `\scope=\name`, the scope of the definition can be modified. \knowledge will first check if there is an outer area of this name, that accepts knowledge (only scope environments are subject to this unless \knowledgeconfigureenvironment is used, or the scope package option is used when loading the package). If this is the case, the knowledge will be associated to the corresponding instance. For instance, inside a theorem, by default, the scope is the theorem, but adding the directive `\scope=section`, the \knowledge becomes available in the whole section.

  If no scope is found using the above search, a label of the given name is searched for, and if it exists, the corresponding scope is chosen.

- **export=** (not implemented) When using this directive, the knowledge will be (furthermore) written in another file, ready for being used in another document. In particular, the knowledge (in the other document) will point to the present one. The details on how this is supposed to work is to be specified.

- **namespace=** Allows to change the namespace. In itself, this is useless. It has to be used in conjunction with new forms of \kl-like commands.

- **now** requires the \knowledge to be defined immediately. This may save one compilation phase. The drawback is that the \knowledge cannot be accessed before the \knowledge command that has been introduced. It may help for modularity considerations. (for instance a \knowledge is used inside a proof, it has no sense to make it available elsewhere, and it is better style to locally define it).
also now requires the \texttt{knowledge} to be defined immediately as well as delayed to the next compilation phase. This is in particular how \texttt{autoreferences} should be handled. See the use of \texttt{\knowledgenewvariant} for more examples.

### 3.3.3 General directives

We give here the list of \texttt{display directives} that are available without loading any sub packages. A certain number of Boolean directives are available without any options. These most of the time are used for typesetting the output. Each of these can be used as ‘\texttt{bool=true}’ (or shortly just ‘\texttt{bool}’), ‘\texttt{bool=false}’ or ‘\texttt{bool=default}’ (that leaves it in the default state, or the one determined by surrounding knowledges). The general boolean \texttt{directives} are the following:

- \texttt{emphasize} forces the text to be emphasized using ‘\texttt{\emph}’,
- \texttt{italic/up} forces/unforces italic (be it in math or text mode),
- \texttt{boldface/md} forces/unforces boldface (be it in math or text mode),
- \texttt{underline} forces the text to be emphasized using ‘\texttt{\underline}’,
- \texttt{fbox} puts a box around the text,
- \texttt{typewriter} puts in typewriter font (be it in math or text mode),
- \texttt{ensuretext} guarantees that text mode is used (using the ‘\texttt{\text}’ macro, thus in a way consistent with the surrounding style),
- \texttt{ensuremath} guarantees that math mode is used,
- \texttt{mathord, mathop, mathbin, mathrel, mathopen, mathclose, mathpunct} yield the corresponding standard \LaTeX{} spacing features in math mode,
  - \texttt{mathord} for an ordinary mathematical object,
  - \texttt{mathop} for a large operator (such as \texttt{$\sum, \Pi, \ldots$}),
  - \texttt{mathbin} for a binary operation (such as \texttt{+$, -, \otimes, \ldots$}),
  - \texttt{mathrel} for a binary relation (such as \texttt{=, $<$, $\leq, \ldots$}),
  - \texttt{mathopen} for an opening bracket, parenthesis, \ldots
  - \texttt{mathclose} for an closing bracket, parenthesis, \ldots
  - \texttt{mathpunct} for a punctuation symbol.
- \texttt{lowercase} puts the content in lowercase,
- \texttt{uppercase} puts the content in uppercase,
- \texttt{detokenize} detokenizes the content, i.e., instead of executing it provides a string that displays it (this is useful for commands),
- \texttt{remove space}
The non-boolean general directives are the following:

text={text} will execute the \LaTeX code ‘text’ instead of the key used for calling \k. For instance, \knowledge{latex}{text=\LaTeX} will typeset ‘\LaTeX’ properly when used. Surrounding braces can be omitted if there are no commas. Be careful when linking to such knowledges, since the substitution of meaning will happen for all the knowledges linking to it.

link={knowledge} will continue searching the for linked knowledge. Surrounding braces can be omitted if there are no commas. This directive is often bypassed by the use of the optional argument of \knowledge defining synonyms or the synonym directive.

link scope={label} will continue searching in the scope identified by the label. Surrounding braces can be omitted if there are no commas. If no directive link= is given, then the same key is searched for. This directive is often bypassed by the use of the optional argument of \knowledge defining synonyms or the synonym directive.

synonym defines the knowledge as a link to the previously defined knowledge (in fact, the most recently defined that was not using synonym). For instance

\knowledge{Leslie Lamport}  
\{ref={https://fr.wikipedia.org/wiki/Leslie_Lamport}\}  
\knowledge{L. Lamport}{synonym}  
\knowledge{Lamport}{synonym}

results in the two subsequent knowledge names to point to the first one.

style={knowledge style} will adopt the styling option of the knowledge style. Surrounding braces can be omitted if there are no commas.

wrap=\token will execute the macro ‘\token’ with as argument the knowledge text before displaying it. For instance, wrap=\robustdisplay (where \robustdisplay is a variant of \tl_to_str:n removing the trailing space) is used in this document for typesetting the commands.

3.3.4 Knowledge styles and the \knowledgestyle command

Styles are formatting pieces of information, as for knowledges but that can be used by other knowledges. In some respect, this is very similar to macro directives (see below), but the difference lies in that styles are dynamically resolved, while macro directives are statically resolved. Styles in particular offer the access to some configuration features of the system. For instance, changing the intro style changes the way the \intro command is displayed. See below for some instances.

The central command is \knowledgestyle that has the following syntax:

\knowledgestyle*{style name}{directives}

The optional star permits to overload an existing style (otherwise, this results in an error). The directives follow the same structure as for a normal \knowledge command. When defined, a style can be used in a \knowledge command using the directives style=’style name’ (it will be used when a \k command calls
for the \texttt{knowledge} or \texttt{intro style} style name (that will be used by \texttt{intro} commands).

A certain number of default styles are also offered, that in particular includes warning styles. The list is as follows:

- \texttt{kl} is the default style for macros using \texttt{\kl}. It can be modified dynamically using the \texttt{\kl style=} directive.
- \texttt{kl unknown} and \texttt{kl unknown cont} are the default styles used when an undefined knowledge is met.
- \texttt{intro} and \texttt{intro style=} is the default style for macros using \texttt{\intro}. It can be modified dynamically using the \texttt{\intro style=} directive.
- \texttt{intro unknown} and \texttt{intro unknown cont} are the default styles used when an undefined knowledge is met.

### 3.3.5 New directives: the \texttt{\knowledgedirective} command

When defining knowledges, it is often the case that the same sequence of directives are used. Macro directives are here for simplifying this situation (see also \texttt{\knowledgedefault} and \texttt{\knowledgedirective}). This is achieved using the \texttt{\knowledgedirective} directive:

\begin{verbatim}
\knowledgedirective{name}[optional parameter]{directives}
\end{verbatim}

After such a command has been issued, ‘name’ becomes a directive usable in \texttt{knowledge} commands, that amounts to execute the comma separated list ‘directives’. The newly created directive may receive a value, that is accessible as \#1 in ‘directives’. The ‘optional parameter’ gives a default value. For instance:

\begin{verbatim}
\knowledgedirective{highlight}[brown]{color={#1},emphasize,md}

\knowledge{notion A}{highlight}
\knowledge{notion B}{highlight}
\knowledge{notion C}{highlight}
\knowledge{important notion D}{highlight=red}

We shall now see \texttt{\kl{notion A}}, \texttt{\kl{notion B}}, \texttt{\kl{notion C}}, as well as the \texttt{\kl{important notion D}}.
\end{verbatim}

yields

\begin{verbatim}
We shall now see notion A, notion B, notion C, as well as the important notion D.
\end{verbatim}

### 3.3.6 \texttt{\knowledgedirective} versus \texttt{\knowledgedirective}

The two commands \texttt{\knowledgedirective} and \texttt{\knowledgedirective} offer ways to systematize the writing of knowledges. These can seem redundant. This is not the case, and for understanding it, it is necessary to understand a bit the way the \texttt{knowledge} command works.
In general when a `knowledge` (or `knowledgestyle`) command is found, the directives are parsed and a new internal form of the `knowledge` command is written in the `kaux` file, that will be executed during the next compilation of the document. In this phase, some first operations are performed. For instance, in an `autoref` directive an internal label name is constructed. Executing a `knowledge` macro is done at this moment.

The postponed command is then executed during the next compilation phase (or immediately if we are in the preamble, or if the `now` directive is used). The execution effectively stores the `knowledge` in the system. This is only at that moment that the `knowledge` becomes available to be used by `\kl` and similar commands.

When a `\kl` command (or similar) is met, it is ‘executed’, and display informations are considered, and in particular `styles` are called.

Some consequences of this kind of this are as follows:

- `autoref` directives should not be used in the definition of a `style` since this would mean that there would be one anchor point for all the `knowledges` that use this `style`. This is usually not the kind of behavior that we expect.
- configuring the default displays of the system (such as the `intro style=` in particular) has to be done through the `style` mechanism.
- `styles` use less memory than macros.

### 3.3.7 Default directives: the `\knowledgedefault` command

It may happen that a sequence of consecutive `knowledge` commands have to share the same list of directives. The macro directives can help solving this issue. The `default directives` also go in this direction, using the `\knowledgedefault` command:

```
\knowledgedefault*{directives}
```

When such a command is applied, then from that point, all `knowledge` commands will use the given `directives` as default. This will stop when another `\knowledgedefault` command is met or the current group is closed. The optional star does not reset the `default directives` but simply add new ones.

### 3.4 The `\kl` command

#### 3.4.1 The standard syntax

```
\kl(optional label)[optional knowledge name]{text}
```

Its meaning is to search for the ‘optional knowledge name’ if present, or for ‘text’ otherwise. How this is exactly performed depends on the presence of the `optional label`. The search process is as follows:
• if an optional label is given, the knowledge is searched in the corresponding scope.
• otherwise, the stack of visible scope instances is processed through (starting from the inner most) until a knowledge of name 'knowledge name' or 'text', of namespace 'default' and this scope is found. If the ‘knowledge name/text’ has not been found, the style 'kl unknown' (or similar styles, as defined by the unknown style= or unknown style cont=) is used, and the text displayed.
• Otherwise, the knowledge is executed. If it is a link= or synonym defined knowledge, the link is followed, and the process continues.
• Finally, all the definitions involved in the knowledge are processed, following a style= if defined, the knowledge is updated (essentially incrementing the counter of use), and the knowledge is displayed.

This general mechanism is used also by other commands that are variations around \kl such as in particular \intro

3.4.2 The quotation notation

When activated, the quotation mode activates shorthand notations for the \kl and \intro macros. Possible syntaxes are as follows:

"text" uses the knowledge pointed to by ‘text’. Equivalent to \kl{text}.

"text@knowledge" uses the knowledge pointed to by ‘knowledge to display ‘text’. Equivalent to \klknowledge{text}.

"text@label" uses the knowledge pointed to by ‘text’ in scope ‘scope’ to display ‘text’. Equivalent to \kllabel{text}.

"text@knowledge@label" uses the knowledge pointed to by ‘knowledge in scope ‘scope’ to display ‘text’. Equivalent to \klknowledge(label){text}.

""text"" introduces the knowledge pointed to by ‘text’. Equivalent to \intro{text}.

""text@knowledge"" introduces the knowledge pointed to by ‘knowledge while displaying ‘text’. Equivalent to \introknowledge{text}.

""text@label"" introduces the knowledge pointed by ‘text’ in scope ‘scope’. Equivalent to \intro(label){text}.

""text@knowledge@label"" introduces the knowledge pointed to by ‘knowledge in scope ‘scope’ while displaying ‘text’. Equivalent to \introknowledge(label){text}.

Activating and deactivating the quotation notation is obtained using:

\knowledgeconfigure{quotation}.
and deactivating it is obtained using:
\texttt{\knowledgeconfigure\{quotation=false\}}.

It can also be activated while loading the package.

It is sometimes the case that some packages do use the quote symbol, usually in some environment (this is the case of the \texttt{tikzcd} environment). The \texttt{knowledge} package can be configured to deactivate always the \texttt{quotation notation} when entering the environment. This is obtained using the \texttt{configuration option protect quotation=} followed by a list of environments to be protected:
\texttt{\knowledgeconfigure\{protect quotation=\\{env1,env2,\ldots\\}\}}

Note that the braces surrounding the list of environments can be omitted if the list contains only one item.

There are nevertheless some situations in which one would prefer to use the original \texttt{\kl} notation:

- When nesting of \texttt{knowledges} is involved, or the \texttt{knowledge} includes the symbol ",",
- when \texttt{quotation} is deactivated (or not activated) because of a conflict
- in particular, this should be avoided in macros, in particular for the math mode, since these may be used one day or another in a \texttt{tikzcd} or similar environment for instance.

3.4.3 Variants of \texttt{\kl}, \texttt{\knowledge newvariant}, \texttt{\knowledge variantmodif}\texttt{-}\texttt{er}

It may happen for several reasons that we may want to define new variants of the \texttt{\kl} macros, that essentially perform the same task, but are configured differently. Typical examples may be:

- several sets of \texttt{knowledges} may intersect but should use different \texttt{namespace}
- some \texttt{knowledges} involve macros and for this reason should be non-expanded even if the \texttt{knowledge} command is not met,
- the \texttt{knowledge} command should be performed automatically,
- activate or deactivate the warnings or messages in the \texttt{diagnose file}

In fact, several macros in this document are instantiation of this mechanism. This is the case for for instance for \texttt{\intro} \texttt{\phantomintro} \texttt{\reintro} or \texttt{\mathkl} etc...

The macro for introducing a new \texttt{variant of} \texttt{\kl} is:
\texttt{\knowledge newvariant\\{variant directives\}}

and is similar to the one for modifying the behavior of a \texttt{variant of} \texttt{\kl}:
\texttt{\knowledge set variant\\{variant directives\}}.
These command define/modify a/the macro \texttt{\textbackslash variant} that uses the same syntax as \texttt{\textbackslash kl}. The \texttt{variant directives} consist of a comma separated list of \texttt{directives} as follows:

\texttt{namespace}\texttt{\textasciitilde namespace} declares in which \texttt{namespace} (a string) the knowledges are to be searched. This means in particular that the \texttt{knowledge} concerned should be defined using the the proper \texttt{namespace}\texttt{\textasciitilde namespace} directive.

\texttt{default style\textasciitilde, unknown style\textasciitilde, unknown style cont\textasciitilde\{list of style names\}} declares the style name to be used (1) by default when the \texttt{knowledge} is found, (2) when it is not found for the first time, and (3) the subsequent times.

\texttt{style directive\textasciitilde\{directive names list\}} defines a list (comma separated) of directives that can be used in a \texttt{knowledge} command to modify the aspect (for instance, the \texttt{intro} behavior is modified by the \texttt{intro style\textasciitilde directive}, while the \texttt{kl} command is configured using the \texttt{style\textasciitilde directive}). If the directives do not exist, these are created.

\texttt{auto knowledge\textasciitilde\{directives\}} declares that the use of \texttt{\textbackslash variant} should automatically execute a \texttt{knowledge} command, and what should be the directives it uses. See examples below.

\texttt{unknown warning\textasciitilde true\textasciitilde false} activates or deactivates the warnings when a \texttt{knowledge} is not found (for instance, these are deactivated in \texttt{paper mode}). True by default.

\texttt{unknown diagnose\textasciitilde true\textasciitilde false} activates or deactivates the corresponding messages in the \texttt{diagnose file}. True by default.

\texttt{suggestion\textasciitilde\{directives\}} configures the \texttt{directives} to be suggested in the \texttt{diagnose file} when the \texttt{knowledge} is unknown.

\texttt{PDF string\textasciitilde\{code\}} gives a substitute text for \texttt{hyperref} to use for producing the bookmarks. This code has to be expandable. The code may use three parameters; \texttt{\#1} is the main text of the command, \texttt{\#2} is the optional parameter, and \texttt{\#3} is the scope. The macro \texttt{\textasciitilde IfNoValueTF} of the package \texttt{xparse} can be used to test if the second and third arguments are present. By default, the code is \texttt{\{\#1\}}. Note that the star syntax cannot be used in this context. If the expected result cannot be achieved using this directive, the less convenient macro \texttt{\textbackslash texorpdfstring} of the \texttt{hyperref} should be used.

The second feature is to use \texttt{modifiers}. These correspond to the starred version of the command. For instance, one expects \texttt{\textbackslash intro\textbackslash kl} to reduce to \texttt{\textbackslash intro}. For this, one has to declare explicitly the reduction using:

\begin{verbatim}
\knowledgevariantmodifier{starred sequence}\texttt{\textbackslash variant}
\end{verbatim}

in which the \texttt{starred sequence} is of the form \texttt{\textbackslash variant1\textbar\textbackslash variant2\textbar\ldots\textbar\textbackslash variantk}. This sequence is declared to reduce to \texttt{\textbackslash variant}. For instance, \texttt{\knowledgevariantmodifier{\textbackslash intro\textbar\textbackslash kl}\textbackslash intro\textbackslash kl} declares \texttt{\textbackslash intro\textbackslash kl} to reduce to \texttt{\textbackslash intro}.  23
3.4.4 Examples of variants of $\texttt{\textbackslash kl}$

The best way for introducing new variants is to look at examples. We provide two of them now. The first one is the configuration of the $\texttt{\textbackslash kl}$ and $\texttt{\textbackslash intro}$ commands as defined in the package. The second one is the code used in this documentation for displaying macros, defining the macros $\texttt{\cs}$ and $\texttt{\csintro}$.

**The configuration of $\texttt{\textbackslash kl}$ and $\texttt{\textbackslash intro}$** It is also interesting to see this code since it gives more ideas on how to modify the standard behaviour of these commands correctly.

```latex
\knowledgenewvariant{\kl}{
  namespace=Default,
  default style={\kl,autoref link},
  unknown style= \kl unknown,
  unknown style cont= \kl unknown cont,
  style directive= \texttt{style}
}
\knowledgenewvariant{\intro}{
  namespace= default,
  default style= {\intro,autoref target},
  unknown style= \intro unknown,
  unknown style cont= \intro unknown cont,
  style directive= \intro style
}
\knowledgevariantmodifier{\intro*}{\kl}{\intro}

Note that $\texttt{\reintro}$ and $\texttt{\phantomintro}$ are defined using similar code.

**Displaying control sequences** The second code example is used in this document (the documentation of the package) and consists of two macros $\texttt{\cs}$ and $\texttt{\csintro}$ which have the following semantics:

- these have the same syntax as $\texttt{\kl}$ and $\texttt{\intro}$ respectively.
- these are used to display control sequences without executing it.
- if $\texttt{\csintro}$ is never used, it appears in black,
- is $\texttt{\csintro}$ is used, then it is in color blue, and the calls to $\texttt{\cs}$ are in dark blue, and furthermore, the $\texttt{\cs}$ calls possess an hyperlink to the call to $\texttt{\csintro}$
- no $\texttt{\knowledge}$ command is necessary, and no warnings are issued.
Several things can be noted about this code:

- the directives `detokenize` and `remove space` prevent the execution of the argument, and instead display its name, this is important since the argument is a control sequence,
- the directives `typewriter`, `up` and `md` give a uniform aspect (no italic, no boldface) to the result in all contexts,
- the `namespace` is set to be different from the default one, avoiding possible clashes with \kl,
- when a `csintro` command is met, the corresponding `knowledge` command is automatically issued, in particular with `scope=document` for guaranteeing the visibility of each command everywhere in the document,
- the `also now` directive is necessary for the compilation to (possibly) stabilize in two iterations, since it uses the proper `\label` already at the first iteration (without `also now` it would be performed on the second one only, and with just `now` it would be visible only by the uses after the introduction).
- warnings and diagnose information is explicitly eliminated.
3.5 Scoping

Rapidly, when long documents are in construction, one wants knowledge to be isolated in some subparts. For instance, one may want that a temporary definition in a proof to not leak elsewhere in the document where the same term could be used with a different meaning. Some definitions may be only meaningful in, say, the current section/part. This is in particular true when one aims to track single variables: Clearly, a variable named \textit{x} can occur in several lemmas, but each of them correspond to a distinct ‘introduction’ location. For handling this situation, the \texttt{knowledge} package possesses some scoping features.

Note that the use of \texttt{scopes} may overconstrain the latex code, in particular if the \texttt{scope} is used. The result is that a code that was compiling before activating the option, will not after doing it. This may happen for instance if one uses a \texttt{section} command inside a a \texttt{theorem} environment. Of course, though this is not forbidden by \LaTeX, this is not something that one usually wants to do. At any rate, the scope handling of the \texttt{knowledge} package — at least in its current form — complains in such a situation. Indeed, it attempts to reconstruct a full hierarchically decomposed version of the document. In the above example, when the \texttt{section} command is met, the package attempts to close the outer section, but this would force the theorem also to be closed. However, closing a theorem requires an \texttt{end} command. Error...

3.5.1 What is the structure of \texttt{scopes} in a document

To start with, one needs to understand what are the possible \texttt{scopes}.

- By default, all the body of the document belongs to a \texttt{scope} called ‘document’. The user can open new scopes using the \texttt{scope} environment:

\begin{scope}
  \begin{knowledge}{local notion}{color=green}
  Here is a \texttt{kl} that appears in green.
  \end{knowledge}
\end{scope}

But this \texttt{kl} is undefined.

Note that scoping is independent from the grouping mechanism of \LaTeX.

The user can also declare an environment (existing or to exist) to behave like \texttt{scope} using the command \texttt{knowledgeconfigureenvironment}.

- The use of the \texttt{scope configuration option} reconstructs the structure of the document, and \texttt{scopes} will be created for sections, subsections, itemize, items, and so on. But be cautious, this feature, though working, may cause some compiling document to not compile anymore if some weird (and unnatural) nesting of scopes are used.

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3.5.2 How is chosen the scope of a \texttt{knowledge}?

In general, when a \texttt{knowledge} command is used, the system tries to figure out what should be its scope:

- If the command occurs in the preamble, then the default scope will be ‘document’.
- Otherwise, the information is searched for in the stack of visible scope instances which means that the knowledge will be defined at the level of the innermost surrounding scope that ‘attracts knowledges’. If the \texttt{scope option} is not activated (and the user did not perform its own configuration), this is the innermost \texttt{scope} environment (or similar environment if \texttt{knowledgeenvironment} has been used), or ‘document’ if the declaration is not in the scope. If the \texttt{scope option} is used, this will be the innermost lemma, proof, or theorem in the context.
- This default behavior can be modified using the \texttt{scope=} directive. The \texttt{scope=} directive can be followed with a scope level, such as ‘section’, ‘subsection’, ‘chapter’ or ‘itemize’ (in particular in combination with the \texttt{scope option}), that will be looked for in the current context and will receive the knowledge. The directive can also be followed by a label name, and the active scope at the moment of this label will be used.

The following code (that requires the \texttt{scope option} for being functional) should be self explanatory:

\begin{verbatim}
\section{First section}
\label{section:first}
\knowledge{one}{scope=section,color=green}
\knowledge{two}{scope=some label,color=green}

\begin{scope}\label{some label}
Here \kl{one} and \kl{two} are defined.
\end{scope}
Here \kl{one} is defined but \kl{two} isn’t.
\section{Second section}
Here neither \kl{one} nor \kl{two} is defined. However, I can still use them using \kl{section:first}{one} and \kl{some label}{two} (or "one@section:first" and "two@some label", or using the \texttt{knowledgeimport}{section:first}).
\end{verbatim}

3.5.3 Accessing other scopes, the \texttt{knowledgeimport} command

Something important is missing so far: one rapidly wants to access to \texttt{knowledges} that do not exist in the current scope. For instance, a notion is used in a section of a document, and one would like to refer to it in the introduction. Another case
is that of a notion or a mathematic variable that is introduced in the statement
of a theorem, and should be accessible inside the proof. There are essentially
two ways to access such distance knowledges either use the \( \texttt{\textbackslash kl} \{\texttt{label}\}\{\texttt{text}\} \)
command (or the equivalent "...@...@..." notation), or use the \texttt{knowledge-}
import command. We describe the second possibility now. The syntax is:

\texttt{knowledgeimport\{label\}}

The result is that the knowledges in the scope identified by the label are now
accessible until the closure of the current scope.

For instance:

\begin{verbatim}
\knowledgeconfigureenvironment\{theorem,proof\}\{

\begin{theorem}\label{theorem:1}
\knowledge\alpha{autoref,color=red}
Let $\intro\alpha$ be an integer [...] 
\end{theorem}

\begin{proof}
\knowledgeimport\{theorem:1\}
But now $\kl\alpha$ points to its definition.
\end{proof}
\end{verbatim}

3.5.4 Managing scoping environments

The user can also declare an environment to behave like scope using the command
\texttt{knowledgeconfigureenvironment} as well as adapt some of its characteristics
using scope directives.

\texttt{knowledgeconfigureenvironment\{environments\}\{scope directives\}}

For instance:

\begin{verbatim}
\knowledgeconfigureenvironment\{lemma,theorem,fact,proof\}
\{knowledge=attracts\}
\end{verbatim}

will induce the corresponding environments to have internal knowledges.

Most of the times, it is not necessary to use scope directives.

Remark 1 Note that (in the current implementation) it is necessary to use the
commands \texttt{\begin} and \texttt{\end}. Hence \texttt{\proof...\endproof} would not trigger a
scoping environment while \texttt{\begin\proof...\end\proof} would.

The scope directives are low level and advanced features. These should not be
used in general. Their list is the following:
\texttt{scope=true/false} tells whether an environment should induce a scope. For the moment, this is not used (as soon as configured, it always behave like a scope).

\texttt{label=none/accepts} tells whether a \texttt{\textbackslash label} command can refer to an instance of this area.

\texttt{environment=true/false} should be set to true if the scope has to be opened whenever an environment of same name is opened using the \texttt{\textbackslash begin} and \texttt{\textbackslash end} commands of \LaTeX{}.

\texttt{autoclose=true/false} means that the closure is triggered by another event (closure of another enclosing instance, or pushing of an area that requires its closure). It should be true for \LaTeX{} environments, and false when configuring, e.g. \texttt{\section} to open an \texttt{\scope} (since the end of the section is automatic: when another section is opened, or some higher level sectioning command).

\texttt{parents=\{area1,area2,\ldots\}} takes a comma separated list of areas that are allowed as parent. For opening the area, some enclosing instances may be automatically closed for reaching such a parent (if their \texttt{autoclose=directive} is set to true).

\texttt{push code=\{code\}} defines the code to be executed when the area is pushed (each time, these are added).

\texttt{pop code=\{code\}} defines the code to be executed when the are is popped (added too).

\texttt{occurrences=once/multiple/recursive} can be one of ‘once’ if the area can only have one instance in the document, ‘multiple’ if there can be several instances, but not nested, and ‘recursive’, if there is no restriction.

\texttt{forces=area} requires a specific area as an ancestor of this area. This ancestor is implicitly pushed if necessary.

### 3.6 Error handling

By default, the \texttt{knowledge} package tries to not stop the compilation unless a serious problem has been found. In particular, it is possible to write an entire document using \texttt{\intro} and \texttt{\kl} commands or the quotation notation without ever introducing a \texttt{knowledge} and only in the end provide this information. This is a feature: as opposed to normal macros, not defining a knowledge should not stop the real work, which is the writing of the document.

Very often there is some \texttt{undefined knowledge}. Such \texttt{knowledges} are displayed using \texttt{\kl unknown} and \texttt{\kl unknown cont} styles when issued by \texttt{\kl}, using \texttt{\intro unknown} and \texttt{\intro unknown cont} when issued by \texttt{\intro}. The detail of the problems are then gathered in the \texttt{diagnose file}.

### 3.7 The \texttt{diagnose file}

The \texttt{diagnose file} is a file that is created when the \texttt{knowledge} package is used. It enormously eases the use of the package, and it is a good habit to sometimes check it. It gathers a certain number of informations, that can be warning, code
to be used, or simply information. This file has the name of the tex document with the extension `.diagnose`. Its content is divided into clearly identified parts. Depending on the used options, some of these parts may appear or disappear.

**Undefined knowledges** in this section are listed all the knowledges that have been unsuccessfully searched for. These are given in a line of code of the form `\knowledge{undefined knowledge}{}`. One result of this way of describing is that copying the content of this section to the document itself will solve all problems of `undefined knowledges`. It is an efficient way, when one has written a document without caring so much about knowledges to copy the content of this section, and then modify it/reorganize it, in order to suit ones purposes. By default, no suggestion is offered (i.e., the `{}` braces are empty). Suggestion can be automatically configured using the `suggestion=directive` of the macros `\knowledgenewvariant` and `\knowledgesetvariant`.

For instance, using:

```latex
\knowledgesetvariant\kl{notion}
```

the directive `notion` is suggested for more directly copying the content.

**Autoref not introduced** This section lists all knowledges that were declared using the `autoref` directive (this can be the case indirectly using, e.g. `notion`), but have not been introduced in the document. When a document reaches its final states, this section should be empty. Usually, one should add the corresponding `\intro` or `\phantomintro` command somewhere in the text.

**Autoref introduced twice** In this section, all knowledges that were declared using the `autoref` directive and introduced using `\intro` or `\nointro` more than once are listed. When a document reaches its final states, this section should be empty. Consider using `\kl` or `\reintro` for solving the problem. Note that this may be caused by an `\intro` used in some title (and repeated in the table of contents).

By default, the `diagnose file` does not give the file and the line of the messages. This can be activated using the `\knowledgeconfigure{diagnose line=true}` boolean option:

```latex
\knowledgeconfigure{diagnose line=true}
```

### 3.8 Other packages

#### 3.8.1 The `xcolor` option

The `xcolor` option is used if one wants to change colors. It is good to always load it since it also triggers coloring for debugging. It triggers colors in the `warning` `styles` that can be useful in debugging. It also offers two new directives:

- `color=` where in `color= name`, name is a color description following the syntax of the `xcolor` package.
cyclic color similar to \texttt{color}, but selects the color automatically in a cyclic list of colors. This can be convenient for debugging. The cyclic list of colors can be chosen using the configuration directive \texttt{cyclic colors=}:

```latex
\texttt{knowledgeconfigure[cyclic colors=\{color1,color2,...\}}
```

Note that no spaces are allowed between colors, and that at least two colors are required.

The default cyclic color list is:

```latex
\{red,green,blue,cyan,magenta,yellow,gray,brown,lime, olive,orange,pink,purple,teal,violet\}
```

colorbox= surrounds the text with a colorbox of given color (following the syntax of the \texttt{xcolor} package).

Loading the package before is necessary for changing the options of the \texttt{xcolor} package (for instance for using \texttt{svgnames}).

### 3.8.2 The hyperref option

**Activating the hyperref option** The \texttt{hyperref} option loads the \texttt{hyperref} and triggers a certain number of link-related features. This is done either by the command:

```
\usepackage[hyperref]{knowledge}
```

or by loading the \texttt{hyperref} before the \texttt{knowledge} package.

The directives activated by the package are:

- `url= \{url address\}` puts an hyperlink to an (external) url (the braces can be omitted when there is no comma).
- `ref= \{label\}` puts an hyperlink pointing toward a label inside the document (the braces can be omitted when there is no comma).
- `protect link` it a boolean for protecting from the creation of nested hyperlinks,
- `autoref` for relating objects with their definition
- `autorefhere` similar, and used implicitly for math

The package comes also with the \texttt{configuration directive} \texttt{hyperlinks=} which is a boolean deactivates or reactivates the links.

**Functionnalities triggered by the hyperref option**

- `ref= \{label\}` puts an hyperlink pointing toward a label inside the document (the braces can be omitted when there is no comma).
- `protect link` disable the inside hyperlinks,
- `url= \{url address\}` puts an hyperlink to an (external) url (the braces can be omitted when there is no comma).

**Hint.** You may have to use \texttt{\textasciitilde} instead of \texttt{\~} in url’s addresses.
\autoref activates the ability to introduce once, use several times an instance. This is very convenient when writing scientific documents with many notions. This is the basic directive activating the features of the \texttt{\intro} command.

\autoreffirst puts immediately a label at the location of the definition, and makes all \texttt{\kl} occurrences of this \texttt{knowledge} hyperlink to this location.

\textbf{Hint.} It is usually easier to use the \texttt{notion} directive than simply the \texttt{autoref} directive. Its use it already configured.

\textbf{The autoref directive.} The \texttt{autoref} directive is among the most useful offered by the \texttt{knowledge} package. When set, the \texttt{knowledge} should be used with both \texttt{\intro} (exactly once) – or the "$\ldots$" and "$\ldots\ldots\ldots$" notations (and variants) if \texttt{quotation} is active – and \texttt{\kl} (possibly several times) – or the "$\ldots$" notation if \texttt{quotation} is active. The use of \texttt{\kl} will hyperlink to the location of the \texttt{\intro}.

The syntax of \texttt{\intro} is the same as for \texttt{\kl}:

\begin{center}
\texttt{\intro[optional knowledge name]{knowledge name}}
\end{center}

See \texttt{\AP} below for improving the result.

A typical use looks as follows:

\begin{verbatim}
\knowledge[house][Houses|houses]{autoref}
\begin{document}
[...]
In this document, we will see the very important notion of "houses".
[...]
\AP
Let us define a "house" to be a building that functions as a home.
[...]
\end{document}
\end{verbatim}

yields

\begin{verbatim}
[...]
In this document, we will see the very important notion of "houses"
[...]
Let us define a house to be a building that functions as a home.
[...]
\end{verbatim}

The variant \texttt{\intro*} makes the next \texttt{\kl} command behave like \texttt{\intro}. This is useful in particular in math mode:

\begin{verbatim}
\ Intro [optional knowledge name]{knowledge name}
\end{verbatim}
Let now $\intro\monoid$ be a monoid.

Remember now who is $\monoid$.

**Hint.** This does not work in `align*` and similar environments. Section 4.5 gives some solutions.

The `\phantomintro` version:

\begin{verbatim}
\phantomintro{knowledge}
\end{verbatim}

takes a knowledge and introduces it at the current location, without displaying anything. This is behaves like an invisible intro, i.e., essentially an abbreviation for `\intro{knowledge}`. This can be used as a workaround in environment like `align*` that do not allow the use of labels (see Section 4.5).

The `\nointro` command:

\begin{verbatim}
\nointro{knowledge}
\end{verbatim}

does not display anything and silently prevents the knowledge from issuing warnings because it is not introduced.

The `\reintro` command:

\begin{verbatim}
\reintro{knowledge}
\end{verbatim}

is displayed as for `\intro`, but without being an anchor for hyperlinks, and without counting as a real intro. It is used if there are for some reason several places that should look like an introduction (typically in the same paragraph), but count as a single target. There is a variant `\reintro*` that makes the next `\kl` command behave like a `\reintro` (similar to `\intro*` with respect to `\intro`).

Knowledges that use this directive can be parameterized by modifying the style `intro`.

For modifying the display of knowledges introduced by `\intro` there are new directives:

- `intro style=` that takes the name of a style as argument. This style will be used when the knowledge is used in a `\intro` or `\reintro` command.
- `autoref target` declares the knowledge to be the target of the autoref (this is implicit when using `\kl`).
- `autoref link` requires a link to the target of the autoref to be produced (this is implicit when using `\kl`).

See the use of `\knowledgesetvariant` for examples of configuration.
The \texttt{autorefhere} directive The \texttt{autorefhere} directive silently introduces an anchor point at the location of the \texttt{knowledge} command invoking it. Uses of \texttt{kl} commands will be hyperlinked to this location.

In some sense, an \texttt{autorefhere} directive can be understood as the sequence of a \texttt{autoref} directive that would be immediately followed by the corresponding \texttt{intro} command. This is a bit better since using \texttt{autoref} in the body of the document requires three phases of compilation (two only if in the preamble). However, the \texttt{autorefhere} directive does only require two (as for normal labels).

In fact, this \texttt{autorefhere} directive is what is used underneath when introducing mathematical variables, and should be used for implementing similar behaviors.

Using \texttt{anchor points} The directives \texttt{autoref} and \texttt{autorefhere} use underneath the \texttt{hyperref} package. This means that it puts a label at the place of the \texttt{intro} command, and then points to it. However, the semantics in this case, is to jump to the beginning of the surrounding ‘region’. If the \texttt{intro} happens in a ‘section’ (but not inside a theorem-like environment) then the \texttt{kl} command will point at the beginning of the section, possibly 10 pages above the definition itself.

The standard solution in the \texttt{hyperref} package is to use the \texttt{phantomsection}. This means defining anchor points in the document that will be the target of hyperlinks.

We offer here new commands for helping using this feature:

\texttt{\AP} declares an anchor point at the left of the current column, at the height of the current line. If the configuration option \texttt{visible anchor points} is set (and this is the case by default), a mark will show the precise location of the target. Be careful: it does not work in some situations, like for instance inside the optional argument of an \texttt{item} command (but this is ok elsewhere in an itemize environment), or inside a some macros in mathmode (e.g. fractions). In the particular case of \texttt{item}, one should use instead:

\texttt{\itemAP} Similar to \texttt{\AP} but to be used instead of an \texttt{item}.

Usually putting an \texttt{\AP} (a standard command of the \texttt{hyperref}) at the beginning of every paragraph, and replacing \texttt{item} by \texttt{\itemAP} in itemize-like environments is most of the time good and safe option.

For instance:

\begin{description}
\itemAP[A \texttt{\intro{semigroup}}] is a set equipped with a \texttt{\kl{product}}. \itemAP[A \texttt{\intro{monoid}}] is a \texttt{\kl{semigroup}} that has a \texttt{\kl{unit}}.
\end{description}

yields
In order to describe what is a monoid, let us us first define a product to be an associative binary operator, and a unit to be \( \ldots \)

- A semigroup is a set equipped with a product
- A monoid is a semigroup that has a unit

One can check that the different knowledges are properly hyperlinked, and that precise targets are the one described by \[ \text{AP} \] and \[ \text{itemAP} \]. For helping debugging the anchor points, these are by default made visible as (red) corners on output. When the knowledge package is loaded with the paper option this graphical help disappears. This can also be desactivated using:

\[ \text{knowledgeconfigure}{\text{visible anchor points}=\text{false}} \]

3.8.3 The makeidx option

Activating the makeidx option The makeidx option loads the makeidx package and triggers a certain number of link-related features. This is done either by the command:

\[ \text{usepackage}{\text{makeidx}}{\text{knowledge}} \]

or by loading the makeidx before the knowledge package.

Features When activated, it becomes possible to trigger the \text{index} command when a \text{kl} command is used. The following directives are use:

- \text{index=} is the version that uses the standard syntax of the \text{index} parameter.
- \text{index key=} takes as argument the index key: a text that is used for identifying the index entry (usually an accent free version of it).
- \text{index parent key=} makes the index entry be a subentry of the given main index entry.
- \text{index style=} makes the index entry be a subentry of the given main index entry.

3.9 Dealing with math

This part is under development.

3.10 Fixes

In this section, we present some fixes that have been added to help the user solve problems.
Hyperref and twocolumn It happens that the \texttt{hyperref} and two-column mode yields a fatal error. This happens when a link spans across the boundary between two pages. This is an issue which is not related to the \texttt{knowledge} package, but becomes severely more annoying when more links have to be used. A \textit{workaround} can be tried by using using
\begin{verbatim}
\knowledgeconfigure{fix hyperref twocolumn}.
\end{verbatim}

I do not know to which extend it is compatible with various classes...

3.11 Predefined configuration

3.11.1 The \texttt{notion} directive

The configuration option \texttt{notion} is activated using:
\begin{verbatim}
\knowledgeconfigure{notion}
\end{verbatim}

It automatically configures a \texttt{directivenotion} which is an \texttt{autoref} displayed properly:

- In \texttt{paper mode}, the \texttt{\intro} commands (not in math mode) are emphasized, while the \texttt{\kl} commands are displayed as normal. It has the aspect of a normal paper.
- In \texttt{electronic mode} and \texttt{composition mode} (with the \texttt{xcolor} package), notions are furthermore typeset in blue when introduced, and in dark blue when used. Without the \texttt{xcolor} package, underlining draw the attention to the knowledges (not in math mode).

The behavior of the \texttt{notion} directive is to activate \texttt{autoref} and to configure the following two styles:

- the \texttt{style notion} is used for normal use,
- the \texttt{style intro notion} is used for introduction.

A typical document using notion could start by the following commands:
\begin{verbatim}
\documentclass{article}
\usepackage{xcolor}
\usepackage{hyperref}
\usepackage[paper]{knowledge}
\knowledgeconfigure{notion}
[...]
\knowledge{some text}{notion}
\end{verbatim}

Then the paper is displayed in a colorful way. As soon as the \texttt{false} is replaced by \texttt{true}, the paper becomes black and seriously looking as it should.
4 Some questions and some answers

4.1 How to compile?

As usual with $\text{\LaTeX}$, a certain number of compilation phases are necessary for reaching a document in final form. The problematic point is of course the use of labels, and in particular the $\text{\texttt{intro}}$ command. When it is used, and all the $\text{\texttt{knowledge}}$ commands are in the preamble, then two phases are necessary. When $\text{\texttt{knowledge}}$ commands are used in the body of the documents, then one extra phase is required, meaning three with $\text{\texttt{autoref}}$ definitions. This is also the case when $\text{\texttt{scoping}}$ is used.

4.2 Problem with $\text{\texttt{item}}$ parameters

The use of $\text{\texttt{AP}}$ inside $\text{\texttt{item}}$ does not work. Do not use $\text{\texttt{AP}}$ inside the optional argument of $\text{\texttt{item}}$, and rather use the command $\text{\texttt{itemAP}}$.

Argument of $\text{\texttt{kl}}$ has an extra ‘}’. This is a problem of using optional parameters inside optional parameters such as in $\text{\texttt{item[kl [test] {Test}}]}$. You can surround the content of the optional parameter by two level of curly braces as in $\text{\texttt{item[{{kl [test] {Test}}]}}}$ . The notation “...” does not have this issue.

4.3 Knowledges and moving arguments (table of contents, ...

The use of $\text{\texttt{kl}}$ does not work in (e.g.) the table of content. When the $\text{\texttt{knowledge name}}$ contains expandable macros, or accentuated letters, then these are not copied in the table of content as the exact same text, but are expanded/translated. Thus, when the table of content is displayed, the $\text{\texttt{kl}}$ command complains of not knowing the $\text{\texttt{knowledge}}$. For instance:

```latex
\newcommand\Ltwo {\texttt{\textup{L^2}}} \\
\texttt{knowledge}\Ltwo -space]\Ltwo -spaces}{autoref} \\
\texttt{knowledge}[\texttt{Étale topology}]\Étale topology] \\
\url{https://en.wikipedia.org/wiki/Étale_topology}} \\
\begin{document} \\
\tableofcontents \\
\section{On \texttt{kltwo -space}} \\
\section{On the \texttt{étale topology}} \\
\end{document}
```

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\footnote{with $\text{\texttt{usepackage[utf8]{inputenc}}}$ and, for instance $\text{\texttt{usepackage[T1]{fontenc}}}$ for the accents.}
will result in that both \textbf{knowledges} are considered unknown in the table of contents. For the first one, this is due to the expansion of \texttt{\textbackslash Ltwo}. For the second, this is due to an implicit translation of the accentuated letter into an internal sequence of commands (for instance ‘é’ is translated into the internal sequence ‘\texttt{\textbackslash IE \textbackslash C \{\textbackslash 'e\}}’).

Some solutions are as follows:

- Make the macros non-expandable, for instance using \texttt{\textbackslash newrobustcmd} (of the \texttt{etoolbox} package) or \texttt{\textbackslash NewDocumentCommand} (of the \texttt{xparse} package, with a different handling of arguments) instead of \texttt{\textbackslash newcommand}. Hence:

\texttt{\newrobustcmd}\texttt{\textbackslash Ltwo \{\texttt{\textbackslash ensuremath}\{L\textsuperscript{2}\}}} 

solves the first problem.

- Using an equivalent text that does not have the problem:

\texttt{\textbackslash knowledge}\{\textbackslash 'etale topology}\{\texttt{\textbackslash link=etale topology}\}


\texttt{\textbackslash section}\{On the \texttt{\textbackslash kl}\{\textbackslash 'etale topology\}\}

- Both problems can be solved using synonyms/links that have no problem. For instance:

\texttt{\textbackslash knowledge}\{\texttt{Ltwo-space}\}\{\texttt{\textbackslash link=Ltwo -space}\}

\texttt{\textbackslash knowledge}\{\texttt{etale topology}\}\{\texttt{\textbackslash link=etale topology}\}


\texttt{\textbackslash section}\{On \texttt{\textbackslash kl}\{\texttt{Ltwo-space}\}\{\texttt{\textbackslash Ltwo -spaces}\}\}
\texttt{\textbackslash section}\{On the \texttt{\textbackslash kl}\{\texttt{etale topology}\}\{\texttt{\textbackslash etale topology}\}\}

- Other solutions? None so far. I am trying to systematize the treatment of these problems.

Using \texttt{\textbackslash intro} in a section title causes introducing the knowledge twice. Do not use \texttt{\textbackslash intro} in titles, but rather \texttt{\textbackslash reintro}. If you want the section to be the target of the \texttt{\textbackslash knowledge} then put after the section a \texttt{\textbackslash pantomintro} command.

\texttt{\section\{On \texttt{\textbackslash intro}\{topology\}\}} \quad \texttt{\section\{On \texttt{\textbackslash reintro}\{topology\}\}} \quad \texttt{\phantomintro\{topology\}}

\textit{Problematic code} \quad \textit{A solution}

\textbf{4.4 Problems with \texttt{tikzcd} and other issues with the \texttt{quotation notation}}

The package \texttt{tikzcd} uses (heavily) the quotes. Thus, it conflicts with the \texttt{quotation notation}. Some other packages may do the same. For solving this issue, the only thing to do is to temporarily deactivate the \texttt{quotation notation}. 

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This can be done either explicitly using before each figure:

\knowledgeconfigure{quotation=false}

and after the figure:

\knowledgeconfigure{quotation}

Another possibility is to force some environment to deactivate systematically the quotation notation when used. For instance

\knowledgeconfigure{protect quotation=tikzcd}

will deactivate the quotation notation in all the \texttt{tikzcd} environments.

4.5 Problems with \texttt{amsmath}

The \texttt{\Intro} command does not work in \texttt{align*} or similar environments. It happens that in starred environment (i.e., unnumbered), the package \texttt{amsmath} deactivates the labels. As a consequence the command \texttt{\Intro} which internally uses \texttt{\label} (at least so far), does not work. For the moment, there is no real solution, but a workaround which consists in introducing the \texttt{knowledge} before the incriminated environment using \texttt{\phantomsection} and then use \texttt{\reIntro} inside the environment. Imagine for instance a command \texttt{\SomeCommand}, that inside uses \texttt{\kl}\texttt{\Somecommand}, then:

\begin{verbatim}
\begin{align*}
\Intro*\SomeCommand
\end{align*}
\end{verbatim}

4.6 Hyperref complains

A fatal error occurs in twocolumn mode. A workaround is to use \texttt{\knowledgeconfigure{fix hyperref twocolumn}}.

4.7 Incorrect display

Incorrect breaking at the end of lines (in Arxiv for instance) It may happen that some hyperlinks generated by \texttt{knowledge} are not broken properly at the end of lines. This is an issue with the \texttt{hyperref} package. This in particular happened for files compiled by the Arxiv system while the file on the local computer was not having any problem.

A workaround is to use the \texttt{breaklinks} option of \texttt{hyperref}. The preamble thus looks like:
4.8 Editor

4.8.1 Emacs editor and quotes

The AucTeX mode in Emacs binds the quote symbol to other characters. This is not convenient when using the knowledge package.

This behavior can be deactivated temporarily using:

```
M-x local-unset-key ".
```

or definitively using:

```
(defun my-hook () (local-unset-key "\\")
(add-hook 'LaTeX-mode-hook 'my-hook)
```

4.9 Others

If other kind of problems occur, report them to thomas.colcombet@irif.fr.
5 Resources

5.1 List of commands
\AP introduces an anchor point and put an anchor to it (to be used with the autoref directive).
\intro searches for a knowledge and displays it accordingly.
\kl searches for a knowledge and displays it accordingly.
\knowledge configure configures the package.
\knowledge directive defines a new directive.
\knowledge default declares the default directives to be automatically used in \knowledge commands.
\knowledge import gives access to knowledges existing in other scopes.
\knowledge gene variant defines a new variant of \kl.
\knowledge style defines a new style.
\knowledge variant modifier declares a meaning of * in variants of \kl.
\nointro declares that the knowledge will never be introduced (does not work properly yet).
\phantomintro performs an invisible \intro.
\reintro uses the display style of \intro without introducing an anchor.

5.2 List of environments
export (not implemented) requires exportation of the content.
import (not implemented) declares external resources.
\scope Defines a scope in which knowledges are internal.

5.3 List of directives (to use with \knowledge)
\autoref Activates the \intro feature (requires the \hyperref).
\autoref link activates an hyperlink to the target.
\autoref target puts a target for a hyperlink.
\autoref here creates an anchor point that points to the \knowledge command (Requires the \hyperref option).
\boldface Displays the knowledge in boldface.
\color= Displays the knowledge is the given color (requires xcolor).
\colorbox= Displays the knowledge in a box of the given color (requires xcolor).
\cyclic color= Displays in a color among a cyclic list (requires xcolor).
\detokenize Avoids evaluation of the text.
\emphasize Emphasizes the displayed output.
\ensuretext Guarantees that the output will be displayed in text mode.
\ensuremath Guarantees that the output will be displayed in math mode.
\export= (not implemented)
\invisible= no display
\texttt{italic} displays in italic
\texttt{fbox} Surround the text with a box.
\texttt{md} Removes boldface typesetting.
\texttt{notion} Chooses the text to be displayed in the index.
\texttt{index key=} the key used to choose the place in the index.
\texttt{index style=} the style to be used to display in the index.
\texttt{index parent key=} the parent key in the index.
\texttt{intro style=} Chooses the typesetting in case of an intro.
\texttt{italic} Typesets the output in italic.
\texttt{link=} Follow with the search the linked knowledge.
\texttt{link scope=} Follow the search in the corresponding scope, using the same key, or the one provided by \texttt{link=} if present.
\texttt{lowercase} Put all letters of the output in lowercase.
\texttt{mathord mathop mathbin mathrel mathopen mathclose mathpunct} Selects a spacing behaviour in math mode.
\texttt{protect link} Disables the hyperlinks inside the link.
\texttt{ref=} Links to a label inside the document.
\texttt{scope=} Choose the scope of the definition.
\texttt{style=} Links to a style.
\texttt{synonym} Is a synonym of the lastly defined knowledge.
\texttt{text=} Changes the output text.
\texttt{remove space} removes the spaces from the input.
\texttt{typewriter} Typeset in as with \texttt{texttt}.
\texttt{underline} Underlines the text.
\texttt{up} Removes italic typesetting.
\texttt{uppercase} Put all letters of the output in uppercase.
\texttt{url=} An url to point to (uses the \texttt{hyperref}).
\texttt{wrap=} A macro used to process the displayed text.

5.4 List of configuration directives (to use with \texttt{knowledgeconfigure})

\texttt{composition} switches to \texttt{composition mode}.
\texttt{cyclic colors=} fixes the cyclic list of colors used by the directive \texttt{cyclic color}.
\texttt{diagnose line=}\{true,false\} activates or deactivates the line numbering in the \texttt{diagnose file}.
\texttt{electronic} switches to \texttt{electronic mode}.
\texttt{fix hyperref twocolumn} fixes a known problem between \texttt{hyperref} and the two column mode.
\texttt{hyperlinks=}\{true,false\} activates or deactivates the hyperlinks.
\texttt{notion} activates the \texttt{notion} directive.
\texttt{quotation=}\{true,false\} activates or deactivates the \texttt{quotation notation}.
\texttt{paper} switches to \texttt{paper mode}.
\texttt{protect link} and \texttt{unprotect link} starts and ends respectively a zone in which the \texttt{knowledge} package does not create hyperlinks.

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**protect quotation**={environment list} declares a list of environment in which the **quotation notation** should be deactivated.

**visible anchor points**={true,false} makes the **anchor points** either visible or invisible.
List of default styles

- **intro**
- **kl unknown**, **kl unknown cont**
- **intro unknown**, **intro unknown cont**
- **notion** (if **notion** is activated)
- **intro notion** (if **notion** is activated)